GEOLOGY AND PALÆONTOLOGY.

MAMMALIA OF THE LOWEST EOCENE.—Attention has already been directed, in these pages,[1] to the fauna of an early Tertiary period, probably the Puerco formation, which lies below the Wasatch, in New Mexico. I have recorded the presence of the Creodont genera *Periptychus*, *Tritïsodon* and *Deltatherium*, and probably the Saurian *Champsosaurus*. I now add the genera *Hyracotherium*, *Meniscotherium* and *Mesonyx*, and a number of new forms of considerable interest. These are a new genus allied to *Esthonyx*, and a series of genera and species with a suilline type of dentition, but whose affinities are by no means certain. This point cannot be determined until the characters of the feet are known.

Conoryctes comma, gen. et sp. nov. *Char. gen.*—Allied to *Esthonyx*. Inferior canines not rodent-like, with conic crowns. Molars 3–3, the first one-rooted, the second two-rooted, the third with an anterior conic cusp and a posterior grinding heel. True molars consisting of two lobes, of subcylindric section, separated by deep vertical grooves. Enamel developed on internal and external faces of crowns. *Char. specif.*—Founded on a mandibular ramus which lacks the last molar, and has the crowns of the others worn. The external faces of the molars are much more exposed than the internal, and are somewhat contracted inwards. In the unworn crown there is a distinct anterior inner cusp, which is soon confounded on attrition. The heel of the last premolar has a crescentic section, the internal horn the narrower. The anterior lobe is a robust cone. The base of the second (third) premolar is oblique to the axis of the ramus outwards and forwards. It is possible that there is a minute first premolar filling the short space between the second and the canine. No cingula; enamel obscurely plicate; ramus robust. Length of molars minus the last, .0465; length of base of first true molar, .010; width of do., .009; elevation of crown do., .0055; length of base of fourth premolar, .011; width of do., .008; elevation of crown of do., .0065. Anteroposterior diameter of base of crown of canine, .010. Depth of ramus at first true molar, .023; width of do. at do., .013. This genus differs from *Esthonyx* in the form of the fourth premolar. In the latter the anterior lobe is compressed and trenchant. The species is longer than any of that genus, and nearly equal to the *Ectoganus gliriformis*.

Catathlæus rhabdodon, gen. et sp. nov. *Char gen.*—With this genus I commence descriptions of some genera with bunodont dentition, which has some resemblance to that of some of the hogs. The one above named, with *Mioclænus*, remind one of

[1] April and August, 1881.

Tetraconodon Falc. and Lydd., in the enlarged proportions of their premolar teeth. I compare the genera as follows:

I. Third and fourth superior premolars one or two-lobed externally, and with internal lobes.

a. Superior premolars with two external lobes; inferior fourth with two median cusps.

Premolars not enlarged..... *Phenacodus.*

aa. Superior premolars with one external cusp, enlarged.

Inferior fourth premolar with internal crest and cusp..... *Catathlæus.*

Inferior fourth premolar without internal crest or cusp..... *Mioclænus.*

II. Superior premolars 1, 2 and 3 without inner lobe; third with three external lobes (Pictet).

Premolars compressed..... *Dichobune.*

In the genus *Catathlæus* the development of the premolars is remarkable, while the true molars are relatively small. The last three superior premolars have an elevated internal crescentic cingulum, homologous with the inner lobe of the fourth superior premolar of the ruminants. The general character of the true molars is that of *Phenacodus.* Parts of two or three individuals of this species have come into my possession, one of which includes nearly all of the molar dentition of both jaws. The external cusp of the superior premolars is compressed conic, and the internal cingulum extends to its *anterior* base in the second, third, and fourth. The crown of the last true molar is about as long as wide, while that of the first is wider than long. Each supports seven cusps; two subconic external; one large median internal, which is connected by ridges with a small anterior and posterior median. Then there are a small anterior and posterior internal, making three internal. The internal crest is distinct from the principal cusp in the inferior premolars III and IV, but unites with it in the II; it supports on the IV, an anterior, a median and a posterior cusp, the latter forming part of the rather narrow heel. The true molars I and II have seven tubercles, the four principal ones, and three smaller, one anterior, one posterior, and one median. On the third the posterior forms a large heel. All of the molars, but especially the premolars, have the enamel thrown into sharp parallel folds, in a manner I have not seen in any other mammal. Length of six superior molars, .067; length of three true molars, .029; length of base of third premolar, .012; width of do., .012; width of base of first true molar, .010; do. of third true molor, .009; length of do., .010. Length of base of fourth inferior premolar, .012; width do., .012; of third true molar, .0115; width of do., .009. The teeth indicate an animal of the size of the peccary.

Mioclænus turgidus, gen. et sp. nov. This genus differs from *Catathlæus* in the greater simplicity of the structure of the inferior premolars, which are without internal crest or cusp. The inner lobe of the superior premolars is less developed than that genus. In the *M. turgidus* the characters of *Mioclænus* are

best seen in the subconical tubercles of the premolars, particularly that of the heel of the fourth inferior premolar. In the other three species this heel is more of a crest, and is connected with the principal cusp by a low ridge. The four species may be characterized as follows:

a. Cusps of last premolars conical in both jaws.

Size medium. Last lower molar disproportionately small; cusps low, two anterior inner distinct; true molars, .018.....*M. turgidus.*

aa. Cusps of last premolars compressed in both jaws.

Least. Second and third lower true molars subequal; cusps, especially the internal, elevated; anterior inner confluent into an edge; true molars, .013 *M. angustus.*

Medium. Last inferior molar larger than penultimate; true molars, .014; p. m. III .006.....*M. sectorius.*

Largest. Cusps of inferior molars obtuse; p. m. III .008, its heel short and small *M. mandibularis.*

Of *M. turgidus* there are two specimens; of *M. sectorius* three, and of *M. angustus* and *M. mandibularis* one each.

GEOLOGY OF THE LAKE VALLEY MINING DISTRICT.—This district lies in the Eastern foothills of the Mimbres mountains, New Mexico, at the western border of a plain which extends from the Rio Grande. Several cuttings of the Atchison, Topeka and Santa Fé R. R. disclose the formation of the surface of the plain, while the shafts at the mines, and various monoclinal hills exhibit the general structure of the country.

The more elevated hills are dikes of trachyte-porphyry, and the directions of their axes are various. It partly decomposes into a reddish soil, and partly breaks down into gravel-like fragments. The lowest sedimentary rock I have seen in place is a quartzite, frequently not very hard, and often perforated by irregular cavities. This material forms low hills, and is overlaid by one or two hundred feet of a fine carbonaceous shale from which most of the valleys are eroded. I was unable to determine the age of either this bed or the quartzite. Overlying the shale are from 150 to 200 feet of more or less siliceous limestone, the upper part of which is very fossiliferous. Professor White finds the fossils to demonstrate the age of this formation to be the Middle Carboniferous; see July, 1881, NATURALIST.

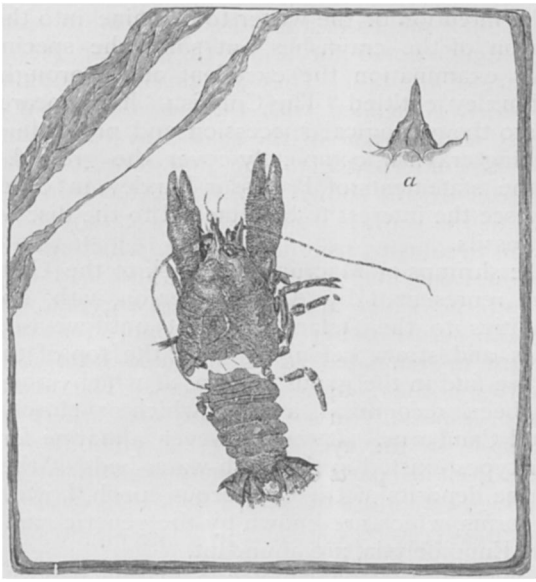
The only formation found covering the limestone is drift. In the foothills this is composed of worn fragments of limestone and trachyte; on the plain it mostly consists of fragments of basalt, with some trachyte, which are more or less coated with lime.

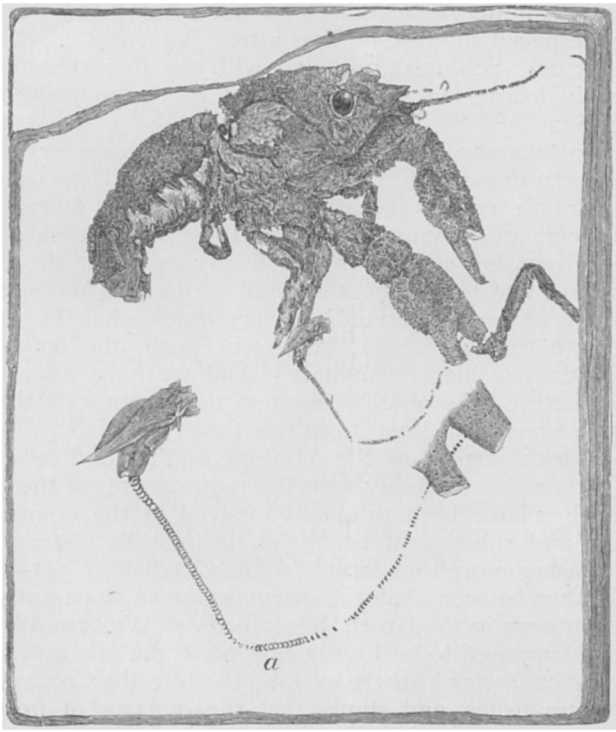
The rich silver deposit which is now attracting attention to this district, is found in the limestone, which forms low monoclinal hills between the higher trachyte ridges and the still lower hills of quarzite. At the Lake Valley mines the dip of the strata is S.S.W. from 12° to 30°. The silver-bearing rock form numerous veins which traverse the limestone from N.W. by W. to S.E. by S., or at right angles to the dips. The veins are of various

widths, from a few inches to a hundred and more feet, and they are nearly uninterrupted for a length of 4000 feet along the sloping surface of the hill. They are probably outflows from an ore body which is bedded with the limestone. At a depth of thirty or forty feet, in some of the shafts, the veins change direction so as to be conformable to the limestone, and many of the veins have been already shown to be connected below the surface. The gangue of the veins is iron oxide and carbonate, with much manganese in pyrolusite, psilomelane, etc., which are mixed with crystalline limestone, chert, etc. Galena and lead carbonate are abundant, and the silver appears as ceratargyrite, embolite and sulphuret. These are either visible in amorphous or crystalline bodies, or are disseminated in an invisible form, but in large quantity, through the gangue substances. The average of the assays is high, especially in some of the ores where the silver is not recognizable by the eye. The green embolite is easily seen in specimens from all parts of this outcrop, and in some larger bodies of gangue it colors the entire rock.—*E. D. Cope.*

A Fossil Tertiary Crayfish.—In a late number of this journal, we described, under the name of *Cambarus primævus*, a fossil crayfish from the Lower Tertiary shales of Western Wyoming. The accompanying illustrations are kindly loaned by Professor F. V. Hayden; they appear in an account of this fossil published in the Bulletin of the U. S. Geological Survey of the Territories. The *Cambarus primævus* is exceedingly interesting from the fact that it represents a period in which heretofore no fossil crayfish has been found. The soft, fine, fissile, clayey shales of the Bear river tertiaries contain not only a good many herring-like fish, but also genuine skates. The presence of land plants mingled with marine animals, shows that the waters were fresh, but communicated with the sea; the conditions were apparently those of a deep estuary into which fresh water streams ran, and in these rivers lived the crayfish. The deposits were probably lower Eocene, and may have been laid down nearer the ocean than those of Green river, if these divisions are to be retained for the Tertiary deposits of the West. At any rate, it is safe to say that the *Cambarus primævus* existed in the Bear river basin in early Tertiary times (the Green river epoch), while the Idaho Astaci were of much later age, possibly of the so-called Pliocene or transition period which connected the Tertiary with the Quaternary period. The *Cambarus primævus* may therefore be regarded as a probable Eocene crayfish.

It thus appears that there is a tolerably complete set of forms of the modern type of crayfish, beginning with the Cretaceous period and extending through the Lower and Upper Tertiary, and culminating in the present assemblage of Astaci and Cambari, with allied forms peopling the cooler parts of the northern hemisphere.





Cambarus primævus, a fossil Tertiary Crayfish.

It was the intention of the writer to examine into the geological succession of the crayfishes, but since the specimens were received for examination, the excellent and thorough work of Professor Huxley, entitled "The Crayfish," has appeared, and his inquiries into the geological succession and probable genealogy of the existing crayfish, completely cover the ground. We will condense the statements of Professor Huxley, in order that the reader may see the interest to be attached to the discovery of the Wyoming fossils.

While the shrimps or Macrura date back to the Carboniferous, being there represented by Anthrapalæmon, with, however, no special affinities to the Astaci, it is not until we ascend to the Middle Lias and strata belonging near the top of the Jurassic series that we find in the genus Eryma, of which some forty species have been recognized, a type which is closely allied to Astacus and Cambarus. It was, however, a marine form, and no fresh-water types existed in the fresh-water beds of the Wealden. In the marine deposits of the Cretaceous epoch, however, astacomorphous forms, which are known by the generic names of Hoploparia and Enoploclytia, are abundant.

"In the chalk of Westphalia (also a marine deposit) a single specimen of another Astacomorph has been discovered, which possesses an especial interest, as it is a true Astacus (*A. politus* von der Marck and Schluter), provided with the characteristic transversely divided telson which is found in the majority of the Potamobiidæ. * * *

"If an astacomorphous crustacean, having characters intermediate between those of Eryma and those of Pseudastacus, existed in the Jurassic epoch or earlier; if it gradually diverged into Pseudastacine and Erymoid forms; if these again took on Astacine and Homarine characters, and finally ended in the existing Potamobiidæ and Homarina, the fossil forms left in the track of this process of evolution would be very much what they actually are. Up to the end of the Mesozoic epoch, the only known Potamobiidæ are marine animals. And we have already seen that the facts of distribution suggest the hypothesis that they must have been so, at least up to this time.

"Thus, with respect to the ætiology of the crayfishes, all the known facts are in harmony with the requirements of the hypothesis that they have been gradually evolved in the course of the Mesozoic and subsequent epochs of the world's history from a primitive astacomorphous form."—(The Crayfish, p. 341–346.)

It will thus be seen that the discovery of an apparently fresh-water Cambarus in the Green River beds of Western Wyoming, which are supposed to be Lower Eocene strata, fills up a break in the geological series hitherto existing between the Cretaceous and Pliocene crayfishes, and shows that the dynasty of fresh-water crayfish, now so powerfully developed in the United States, began its reign during the early Tertiary period.—*A. S. Packard, Jr.*

GEOLOGICAL NOTES.—Professor E. W. Hilgard summarizes in the *American Journal of Science* for July the facts for a hypothesis of a temporary and partial isolation of the Gulf of Mexico from the Atlantic ocean during the later portion of the Tertiary period. In the same journal Professor R. P. Whitfield refers a group of supposed fossil vegetables, named Dictyophyton, to the sponges, and in this view he is confirmed by Dr. J. W. Dawson.——Professor G. H. Stone publishes in the Proceedings of the Boston Society of Natural History, an elaborate discussion of the kames of Maine and the northern States, and in the same publication Dr. M. E. Wadsworth treats of the origin of the iron ores of the Marquette district, Lake Superior, endeavoring to prove that they are eruptive rather than sedimentary. Two other contributions to lithology are comprised in Dr. G. W. Hawe's paper on normal mesozoic diabase upon the Atlantic border, and on the determination of feldspar in thin sections of rocks, in the Proceedings of the National Museum.

GEOGRAPHY AND TRAVELS.[1]

THE IMPERIAL GAZETTEER OF INDIA[2].—The six volumes of this great work now published, with the three yet to be issued, will form one of the most important additions yet made to geographical literature. That excellent authority, Mr. Clements R. Markham, contributes a review of the work to the London *Academy*, from which we learn that in 1862 Madras, Bengal and the central provinces of India, feeling the need of correct information, organized plans for supplying a want for which no provision had been made by the general government and the compilation of manuals for special districts was begun. But the need was felt of a uniform system and a central supervision. In 1869, Dr. Hunter submitted his plan. "It clearly defined the objects of the undertaking and discussed the system through which these objects might best be secured. A series of questions was prepared, the answers to which would illustrate the topographical, ethnical, agricultural, industrial, administrative, and medical aspects of an Indian district. Provincial compilers were then appointed and the series of questions served as a basis for each compiler's local survey. The accounts of the districts were brought together by an editor in each province, on a uniform plan, who prepared the gazetteer of the province, the whole being under the supervision of Dr. Hunter, as Director-General of Statistics to the Government of India. Thus, in the space of twelve years an elaborate account of the 240 districts into which British India is divided was completed, and formed the statistical survey. Such a work, intended as it is to furnish full information to administrators, must

[1] Edited by ELLIS H. YARNALL, Philadelphia.

[2] The Imperial Gazetteer of India. By W. W. Hunter, C. I. E., LL.D., Director-General of Statistics to the Government of India. London, 1881.